UNIVERSITY
OF SKÖVDE

School of **Bioscience**

WRITTEN EXAMINATION

Course **Biochemistry**

Examination **Supervised written examination**

Course code **Ke314G**

Credits for written examination **3**

Date **2025-01-13**

Examination time **14.15-18.30**

Examination responsible **Mikael Ejdebäck/Patric Nilsson**

Teachers concerned **Patric Nilsson**

Aid at the exam/appendices: **calculators provided by the university or the student´s own calculator**

Other: All answers must be given in the exam sheet. Answers given on extra/additional sheets will not be considered. No exceptions

Instructions

- ☐ Take a new sheet of paper for each teacher.
- ☐ Take a new sheet of paper when starting a new question.
- ☐ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☐ Use page numbering.
- ☒ Don´t use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points: to pass the exam, all learning objectives (two on this exam) need the grade E or higher.

To pass a learning objective, 50% correct answers are required.

Grade scale: F< 25 <= E < 30 <= D < 35 <= C < 40 <= B < 45 <= A

Examination results should be made public within 18 working days

Good luck!

Total number of pages

Course code: KE314G
Date: 2025-01-13

Important information regarding the exam:

The supervised written exam examines two objectives in total:

- describe the metabolism of carbohydrates, proteins and fats, and its regulation and integration, (40p in total)
- be able to describe the role of proteins as catalysts and perform enzyme kinetic analyses and
  calculations (10p in total)

To pass the supervised written exam, all learning objectives require the grade E or higher. To pass a learning objective, at least 50 % correct answers are required.

Important things to keep in mind while writing the exam: The teacher who corrects the exam is not a mind-reader. This means that you need to show every step in your calculations otherwise it is very difficult or even impossible to follow your line of thinking. In the end, this will make a huge difference in the number of points you get on a question if you, by chance, make a simple mistake. It is strongly recommended that you make a flow-chart with all steps required to solve a question before you jump into your calculations.

All answers and calculations should be given in this exam sheet. No additional or extra sheets are allowed. Answers given on an extra sheet will not be considered.

Most importantly, believe in yourself. There are no surprises in this exam. We have talked about all the things over and over again.

Good luck

Patric and Mikael

Learning objective: be able to describe the role of proteins as catalysts and perform enzyme kinetic analyses and calculations. To pass the learning objective, 50% correct answers are required. (5 out of 10p is required)

1 Based on the experimental data in the table below

Substrate concentration (mmol/L)	Velocity (mmol/min) (no inhibitor)	Velocity (mmol/min) (with inhibitor)
1	10	9.4
2	20	14.7
10	35	27
30	43	31.5
80	47	33

You should determine

a) V_{max} and K_M for the enzyme — 4
b) Determine the type of inhibitor that affects the enzyme — 1
c) Give a biochemical explanation to how the inhibitor will affect V_{max} and K_M — 1

2	The enzyme acetyl-CoA carboxylase catalyzes the formation of Malonyl-CoA (the precursor for fatty acid synthesis) a) Explain how acetyl-CoA carboxylase is hormonally regulated	2
	b) Explain how acetyl-CoA carboxylase is allosterically regulated	2
Learning objective: describe the metabolism of carbohydrates, proteins and fats, and its regulation and integration. To pass the learning objective, 50% correct answers are required. (20 out of 40p is required)		
3	During gluconeogenesis, we can synthesis glucose from lactate, triglycerides and even amino acids. a) Explain how lactate is converted to glucose. Your answer should include key organelles as well as all the steps required to convert lactate to glucose.	5

	b) When lactate is converted to glucose, <u>four specific enzymes</u> are needed, i. e enzymes that cannot do they reverse reaction in glycolysis, Which ones?	2
	c) In which <u>organs</u> does gluconeogenesis take place?	1
4	In biochemistry, all metabolic pathways lead to the Krebs cycle and the generation of most of the NADH and FADH2. These two molecules, in return, delivers the electrons to the electron transport chain a) There are several important electron carriers and transporters contributing to formation of ATP. Which ones (name at least 5)?	3.5
	b) Explain why there is difference between in the amount of ATP generated by NADH and DAFH2	2

	c) Which molecule is the last electron acceptor in the electron transport chain?	1
	d) Explain the role of coenzyme Q and cytochrome C in the electron transport chain.	1.5
	e) Explain the role of the malate-aspartate shuffle	2
5	In this question, we focus on different aspects of Fatty acid synthesis a) Which are the key molecules needed for fatty acid synthesis?	4
	b) Explain the first 4 steps of fatty acid synthesis, in words, which also constitute the building block for fatty acid synthesis	4

	c) In steps 5 and 7, we are using one NADPH in each step. Why?	2
6	Proteins, or actually amino acids, can be utilized to synthesize glucose. a) Explain in detail, how we can generate glucose and/or ATP through the transamination of alanine	6
	b) Explain oxidative deamination of glutamate	3

7	Explain the "signal transduction hypothesis" of how we respond to exercise signals? Give at 4 examples of molecules taking part and forward the "message"	3